

## CHAPTER 6

### OVERHEAD LINES AND ASSOCIATED ELECTRICAL COMPONENTS

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#### 6-1. Aerial line work

This chapter includes specific rules for poles and structures and the aerial lines they support along with their necessary pole-mounted equipment. The rules cover pole handling and erection, climbing and working on poles, stringing of lines, working requirements around pole-mounted lighting, equipment and tool handling, and tree and brush trimming required for foliage which impinges upon aerial line right-of-ways.

*a. Working in elevated positions.* Additional safety requirements are imposed on aerial line work. Workers must not only recognize electrical hazards but be trained not to fall. Not all work can be accomplished from aerial lifts. Workers must be trained in safe climbing procedures for situations when limited structure access prevents use of an aerial lift and the structure design cannot accommodate positive fall protection load requirements. Only workers who meet "Qualified Climber" requirements should be permitted to do work which requires climbing poles or trees.

*b. "Qualified Climber" requirements.* Each facility should establish these requirements both for facility and contract personnel. They should apply to all persons whose work involves climbing.

(1) Physical fitness required for climbing should be documented one only by an annual physical, but also be validated by supervisory observation.

(2) Climbing duties should be a part of routine job activities, not an occasional occurrence.

(3) A minimum of 2 years of documented climbing training should be completed. Experience should include hazard recognition and hands-on-training incorporating appropriate safe climbing practices and rescue training.

(4) Demonstrated proficiency is required on structure types similar to those which are to be climbed and should show that these structures have been climbed on a routine basis within the last 5 years.

(5) A worker in training may function as qualified only when working under the direct supervision and observation of a "Qualified Climber."

#### 6-2. Pole handling operations

Precautions are necessary in handling poles safely. Poles are long, heavy, and preservative-treated, thus they pose hazards to the workers involved in installation and dismantling operations. Any mistreatment of poles during installation will degrade their ability to meet service requirements and endanger those workers who climb them.

*a. Direction.* The foreman must direct the handling of poles and give all signals when poles are being lifted or handled. Poles should, whenever possible, be handled starting from the top and the end of the stack. Workers must roll poles away from them using cant hooks or bars. Poles must not be caught with cant hooks while in motion. Whenever possible, carrying hooks should be used when carrying poles.

*b. Pole contact precautions.* Creosote, which is usually applied to poles as a preservative, can cause skin burns on contact. The following precautions should be taken to avoid burns.

(1) Never roll up sleeves when handling poles.

(2) Always wear gloves, and keep your neck well covered with a collar or a handkerchief.

(3) Always keep trousers well down over your ankles as much as practical.

(4) Never rub your eyes or wipe perspiration from your face with your hands or shirt sleeves when they have been exposed to creosote.

(5) Where direct contact with creosote is apt to occur, the hands, arms, and face may be rubbed with a preparation made up of one part gum acacia or gum tragacanth and three parts lanolin. If this preparation cannot be obtained, satisfactory protection can be provided by petroleum jelly (Vaseline). First aid treatment must be obtained immediately if you come in body contact with creosote.

*c. Facility receipt.* Poles are usually shipped to the facility's pole storage yard on flatbeds to which they are secured by skids, stakes, slings, and binding. Removal is safe if done properly. The objective is to unload poles so that none is broken and the poles do not roll onto any worker.

(1) Skids, rope lines, and slings should preferably be 1/2-inch or 5/8inch (12.5 to 16 millimeters) wire rope. These should be inspected to ensure they are sufficiently strong enough for the operation.

(2) All binding wire, stakes, and other fastenings will be inspected for weakness or breakage before unloading.

(3) Always place necessary lines to restrain loads when stakes and binding wires are cut.

(4) The supervisor will determine that all possible persons are safely in the clear before binders or stakes are cut.

(5) Binding wires will be cut with long-handled wire cutters. Never cut binders from the top of the load.

(6) Only one person should be permitted on top of a loaded car at a time. No one should be allowed on top of a carload of poles to cut wires or after any wires or braces have been cut or removed.

*d. Ground handling.* Once on the ground the poles can be positioned by the use of cant hooks. Special precautions should be taken while using these hooks.

(1) Hooks must be sharp and should be protected when not in use.

(2) The hook bolt must be inspected occasionally to detect wear. When a worn hook bolt breaks in use, a sudden and severe fall can result.

(3) Injuries may result when the handle breaks or the hook comes out. Therefore, make sure the hook is firmly set in the pole.

(4) The cant hook is a one-worker tool and frequently breaks when two workers double up. If the job requires two workers, two cant hooks must be used.

(5) Before moving the pole, make sure that there are no tripping hazards behind any workers.

(6) Stand so the pole is rolled away from you. Pulling the pole toward you can allow the pole to roll on your foot or even crush your leg. Also watch to see that the pole does not roll up a hump, as the pole could roll back when the grip and position of the hook is changed.

*e. Temporary pole storage.* Storage of poles must

ensure that they will not deteriorate because of mis-handling.

(1) Poles that are stored for considerable periods should be stacked above the ground on racks which provide sufficient ventilation and can be properly blocked to keep them from shifting or rolling.

(2) Poles should never be stored with cross-arms, braces, steps, and hardware attached.

(3) Poles should be stored according to size to make them as accessible as possible.

(4) An area of at least 10 feet (3 meters) around stored poles must be kept free of grass and weeds. There should be sufficient space under the poles to permit removal of leaves and debris. The foreman is responsible for these activities.

(5) Poles stored temporarily on or near roadways, before erection or removal, should be placed as close as possible to the curb or edge of roadway as is safe. Never store poles at points in the road where there are sharp turns. Place each pole so that its top faces the direction of traffic. Poles stored on highways should not have crossarms attached.

*f. Hauling poles.* Pole hauling must be done so as not to endanger workers and or the public.

(1) Poles, after being loaded on a vehicle, must be secured in at least two places and in a manner that ensures poles will not be released in traveling over rough terrain. Never use a chain smaller than 3/8 inch (9.5 millimeters) diameter.

(2) A minimum of at least two people (a driver and a helper) should be assigned to haul a load of poles. The helper should assist the driver by watching traffic both from the sides and the rear. The helper should also see that there is ample clearance when turning corners, entering highways, or crossing intersections. If necessary, the helper should act as flagman to warn and guide traffic.

(3) Poles must not be hauled at night except in emergencies.

(4) Poles extending more than 4 feet (1.2 meters) beyond the back of a truck or trailer will have warning devices attached. Provide a red flag by day and a red light by night to the rear end of the poles being hauled. The red flag or light must be visible in any direction. State highway regulations must be observed when poles are transported on state highways.

(5) Poles temporarily dispersed along streets and highways must be laid near the curb or in parkways between the curb and sidewalk, where they will not interfere with traffic, driveways, or walkways. When laid on an incline, poles must not be placed where they will interfere with drainage. The foreman must decide whether or not danger signs by day and red lights at night are required.

(6) When moving a pole by hand, with a pole cart or with the truck derrick, warn those nearby who might be struck accidentally. Station a worker with a red flag to warn or stop traffic as necessary.

### 6-3. Pole installation requirements

Poles will normally be installed for new aerial line construction by contract workers. However, facility-installed poles may be needed for short line replacements of storm-damaged lines or because of pole decay. Remember that poles and guys must be located relative to local facility property line requirements.

*a. Pole holes.* If new poles are to be set adjacent to existing poles to be dismantled, new holes must be dug. Power tools are available for digging, such as power borers or augers and should be used by qualified personnel. Rock cutting drills are available, as a safer alternative to the use of explosives, where rock is encountered. Most facility-provided pole holes will probably be dug by hand when power diggers are unavailable or cannot be used.

*b. Digging holes.* Digging pole holes does not involve any great hazard, but does contribute to a great number of minor injuries, such as eye injuries from flying dirt and rocks; blisters on hands from the use of hand tools (blisters can be partially eliminated by using gloves); and foot and leg injuries resulting from falling over tools left too close to the pole hole, particularly shovels that have been left turned up.

*c. Hole covers.* Cover all open pole holes as soon as they are dug, except when the pole is to be set into the hole immediately after digging. Hole covers must be at least 30 inches (750 millimeters) in diameter. Covers may be made of 1-inch (25 millimeters) lumber with two cross braces not smaller than 1 inch by 4 inches (25 by 100 millimeters). Four or five shovels of soil should be put on the cover after it is placed over the hole.

*d. Hole casings.* Casings may be required in sand or swampy soil to prevent the sides of a hole from caving in. Casing covers are required if pole setting is not done immediately.

*e. Setting poles.* Pole setting is a hazardous job

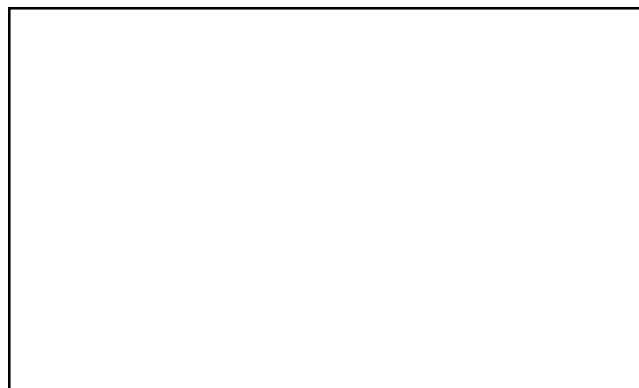


Figure 6-1. Pike pole method

even with the best equipment and experienced personnel. The methods authorized for setting poles are by piking, using the winch line method, or using a gin pole.

(1) *Pike pole method.* Figure 6-1 illustrates the pike pole method. This is the earliest method of raising poles and should be employed when a truck cannot be brought in. A jenny initially supports the pole and a cant hook keeps the pole from rolling. The bumpboard protects the wall of the hole from being caved in by the pole butt. Pikers, lift the line pole, by punching into the pole the steel spikes of the pike poles. The number of pikers required increases with the pole length as shown in table 6-1.

(a) Before setting a pole the foreman must ensure a clear working space and verify that all movable obstacles are removed from the area. Personnel must not wear safety belts and climbers when setting poles. Tools or other items must not be substituted for bumpboards. Always use a jenny to support the pole until it is high enough to use pikes. Only experienced workers should use the jenny. The angle of contact between the pole and jenny should be maintained as close to 90 degrees as possible.

Table 6-1. Average size of crew required to raise poles of different lengths by piking.

| Pole length in<br>feet (meters) |        | Size of<br>crew | No. of<br>pikers | No. of<br>journeyman | No. of<br>people<br>at butt |
|---------------------------------|--------|-----------------|------------------|----------------------|-----------------------------|
| 25                              | (7.5)  | 5               | 3                | 1                    | 1                           |
| 30                              | (9.0)  | 6               | 4                | 1                    | 1                           |
| 35                              | (10.5) | 7               | 5                | 1                    | 1                           |
| 40                              | (12.0) | 8               | 6                | 1                    | 1                           |
| 45                              | (13.5) | 9               | 8                | 1                    | 1                           |
| 50                              | (15.0) | 10              | 8                | 1                    | 1                           |

(b) At least three experienced workers must be used in addition to the supervisor. One person should handle the butt of the pole and a minimum of two side pikers are needed. Unexperienced workers used in this work must be thoroughly instructed on the hazards involved. A two-legged jenny must be used. It is the responsibility of the supervisor to assure that all polelifting tools are always in good condition.

(2) *Winch line method.* Figure 6-2 shows the winch line method.

(a) When erecting poles by truck winch and winch line, rig as shown with all workers in the clear. At least three experienced workers must be used in addition to the supervisor. For safe erection, the gins or maneuverable rigging assembly must have enough teeth to handle the pole. Pikes will not be used in combination with a winch.

(b) Side guys used in setting poles or structures will be attached to pencil bars driven into the ground. Tie lines or other guy lines will never be wrapped around any worker's body. The supervisor must concentrate on supervising the work to assure that it is being safely performed.

(3) *Gin pole method.* In setting extra-heavy poles or those of 45 feet (12.5 meters) or longer, use a tackle block attached to another pole (either existing or specially set for the purpose of raising the new pole) rather than the pike pole method. The pole used as a gin (maneuverable rigging point) to raise the new pole, must be guyed sufficiently with not less than 5/8-inch (16-millimeter) diameter rope to hold it erect under the strain of the load. When the new pole is raised by car or truck, the temporary guy must be run from a snatch block at the bottom of the gin pole to a substantial anchor. This prevents the gin pole from slipping at the ground line. Otherwise the gin pole must be set in a hole 1 or 2 feet (0.3 to 0.6 meters) deep.

(4) Pole setting truck precautions. Pole setting trucks should be parked, when practicable, so that the steel boom will not be closer than 10 feet (3 meters) to energized overhead conductors. When the work is to be done around energized conductors and it is impossible to lower the boom sufficiently to be in the clear, the conductors must be de-energized before work is begun. When work is being done with the boom close to energized conductors, all personnel must not touch the pole and must keep away from the frame of the truck. Never touch (with bare hands or with any part of the body) a pole which is being set in an energized line. A cant hook or dry rope



Figure 6-2. Winch line method

around the butt of the pole may be used to guide it into the hole.

(5) *Energized lines.* A lineman-A must be used to guide poles through energized conductors.

(a) When a pole of any type is being set or removed between or near conductors energized at more than 600 volts, the pole, winch cable, and truck frame must be effectively grounded with protective grounds. Lines must be covered with rubber protective equipment to prevent poles from touching energized parts and, workers must use rubber gloves. Attach a protective ground to the frame of all winches. If the pole is to be erected by hand (pikes), the protective ground must be attached to the pole (using an approved grounding band) approximately 15 feet (4.5 meters) from the butt end. In all cases, exercise extreme care to keep the pole from contacting conductors.

(b) Wood poles must not be considered as providing insulation from energized lines.

(6) *Backfilling.* Backfill the hole after the pole has been placed. Use the pikes to align the pole while backfilling. Pikes must not be removed until sufficient tamping has been done to prevent the pole from falling.

f. *Dismantling poles.* Many people have been fatally injured or permanently crippled from accidents during improperly performed pole dismantling.

(1) The following methods must be strictly adhered to. Each pole must be guyed in at least three different directions by guy ropes before any work proceeds on the pole. This can be done by the following procedure:

(a) Make two turns around the pole with a sling and tie securely.

(b) Tie three guy lines around the sling at the proper angles.

(c) Insert pike poles under two sides of the sling well up the pole.

(d) Snub off securely by pencil bars driven into solid ground or by any other substantial snub.

(2) Always check the pole to see if additional support may be necessary because of pole conditions or strains.

(a) Determine the condition of the pole butt before removing guys or wires and support with additional pike poles or temporary guys if necessary.

(b) When an old or reinforced pole is to be dismantled, guy it sufficiently to withstand any altered strain on it and to support the weight of personnel who are to work on it.

(c) When changing the strain on a pole, the foreman should see that it is sufficiently guyed to stand the altered strain. The foreman should not permit workers to climb a pole which is under an abnormal strain. The foreman will be responsible for the placing of guys to prevent any pole from falling.

(3) A truck equipped with an "A" frame and backed up to the pole can be used to restrain the pole. The top of the "A" frame can be tied by the winch line to the pole. The pole at the groundline level can be securely tied off to the truck.

(4) In locations where poles cannot be lowered with a rope or derrick, a guideline must be attached so that the pole falls in the desired direction.

(5) All members of a crew, who are not actually engaged in removal of a pole, must stand clear to avoid possible injury if the pole should fall. Where necessary, stop all pedestrians and traffic during pole removal.

(6) When a pole is being removed, dismantle the pole before beginning excavation around the butt.

#### 6-4. Climbing and working on poles

Workers should be familiar with general rules for climbing poles and approaching the overhead work area; the impacts of climbing wood poles as opposed to steel towers; and the dangers of crossing structures from one side to another.

*a. Climbing and working general rules.* Except in emergencies or when unavoidable, do not work at

the base of a structure or a pole while people are at work above. Before climbing a pole the worker must first determine and ensure—

(1) What circuits are energized and at what voltage, and any unusual conditions which might pose a hazard.

(2) Types and positions of circuits and the direction of feeds.

(3) The best climbing space to avoid all live wires, grounded wires, and signal circuits.

(4) That there is an ample supply of rubber protective equipment on hand to completely protect the worker on the pole from all live wires, grounded wires, and signal circuits.

(5) That not more than one worker will descend a pole at the same time. The first worker will be in place on the pole or down on the ground before the next worker ascends or descends the pole. When it becomes necessary for one worker to work above the other, they will exercise extreme care.

(6) Before climbing poles, ladders, scaffolds, or other elevated structures; riding span wires, messengers or cables; or entering cable cars, boatswain chairs or similar equipment; the worker will first verify that said structure or device is strong enough to safely sustain his/her weight.

*b. Type of pole.* The type of pole to be climbed will affect the precautions that the worker must take in regard to climbing equipment and procedures. However all types of poles must be safe to climb, in terms of being strong enough to bear the weight of the particular climbers and their tools and in providing adequate climbing space. Before allowing anyone to climb on a pole, the foreman will make sure that the pole is inspected and that it can be safely climbed based on the following determinations:

(1) Age, treatment, and physical condition of each pole must be tested according to the applicable provisions of TM 5-684. Poles unsafe for climbing must be reported to the foreman so that they may be braced or guyed before climbing.

(2) Configuration of conductors or equipment on the pole must provide adequate climbing space.

(3) Changes in stress resulting from removal of supporting conductors or guys do not affect the safety of workers.

(4) Poles to be climbed are in such condition and are supported in such a way as to safely support workers on such poles. Pikes will not be used as a support method while personnel are working on poles.

## 6-5. Pole climbing equipment

Usually pole climbing will be done on wood poles rather than on concrete or steel poles. The two major differences between these types of poles are that wood poles are not grounded poles (although they should not be counted as providing protective insulation) and climbing wood poles (along with trees) requires climbers (gaffs) rather than step bolts or ladders. All workers need to be provided with body belts and safety straps when climbing and while working more than 6 feet (1.8 meters) above ground level. Positive fall protection may also be appropriate.

*a. Responsibility.* A full set of climbing equipment must be supplied to each worker who is authorized to climb. Never loan or borrow a set of climbing equipment.

(1) Climbing equipment should be carefully inspected daily. Leather should be checked for cuts, cracks, and enlarged buckle tongue holes. Metal parts should be checked for cracks, wear, or loose attachments. Climbers (gaffs) should be regularly checked for proper cutting edges, length, and shape.

(2) It must be understood by all personnel that the foreman, or a properly delegated worker, will inspect all tools, safety devices, and other equipment weekly. Any item that is not considered safe will be condemned, regardless of ownership, and must not be used.

(3) Body belts, meeting the requirements of OSHA Standard 1926.959, with straps or lanyards, should be worn to protect personnel working at elevated locations on poles, towers, or other structures. If such use creates a greater hazard to the safety of the workers, other safeguards must be employed. Body belts and straps should be inspected before use each day to determine they are in safe working condition.

(4) Positive fall protection. Provide positive fall protection where the strength of the pole (steel/concrete) permits meeting OSHA requirements. Exceptions are ascending or descending by a qualified climber or situations where a job hazard analysis so warrants. On wood structures consider adding position fall protection when transitioning obstructions, if a job hazard analysis indicates a fall arresting point

will provide adequate strength.

*b. Wood-pole climbing equipment.* Equipment sets each consist of a body belt, a pole strap, and climbers (an assembly of gaffs, leg straps, and pads). The Edison Electric Institute provides an excellent document entitled "Use and Care of Pole Climbing Equipment" which should be used as part of the training for pole climbing certification.

(1) Climbers should meet the following requirements:

(a) Leg iron (shank) to be made of spring steel.

(b) Gaff (spur) to be forged from tool steel.

(c) Leg iron length, sizes range from 15 to 18 inches (380 to 460 millimeters) from instep to end of shank.

(d) Leather straps, two each of 1-1/4 inches (26 millimeters) wide, at least 22-inches (560 millimeters) long.

(e) Pads, for protection of calves.

(2) Climbers and pole straps or other leather items which have any of the following defects must not be used until repaired:

(a) Cracked, dry, or rotten leather.

(b) Leather which is worn thin.

(c) Cuts or worn places which are of sufficient depth to weaken the leather.

(d) Broken stitches or loose rivets at buckles, D-rings, or snaps.

(e) Snaps which have weak springs behind the tongue, or loose rivets which hold the tongue.

(f) Loose tongues in buckles.

(g) Buckles, D-rings, or snaps which show considerable wear or which have been cracked or bent.

(3) Leather equipment should be cleaned and dressed every 3 months. This period should be shortened when equipment is frequently wet from rain, perspiration, or covered with dirt or mud.

(a) Wipe off all surface dirt and mud with a

sponge dampened (not wet) with water. Never use gasoline or other cleaning fluids as they tend to dry out and harden the leather.

(b) Wash leather with a clean sponge in clear lukewarm water, and a neutral soap (free from alkali), preferably Castile soap. Thoroughly wash the entire length of the leather and work the lather well into all parts. Place in a cool area to dry.

(c) Leather should be oiled about every 6 months. Use a small quantity, about 4 teaspoonsful (20 milliliters) of pure neatsfoot oil per set of equipment, and apply it gradually with the hands, using long light strokes while the leather is still damp from washing. Leave in a cool place to dry for 24 hours, and then rub the leather vigorously with a soft cloth to remove all excess oil.

(4) When safety belts and straps are not in use, they must be stored in proper compartments on the electric truck or in other suitable places to protect them from being damaged. When stored, climbers should be wrapped in pairs and fastened with their straps.

(5) Climbers, straps, and pads must be kept in good conditions at all times. Gaffs must be at least 1-1/4 inches (26 millimeters) long, measured from the point of the gaff to the point of contact with the stirrup on the under side. Sharpen climbers using a gaff shaping bit as follows—

(a) Place the climber between wood in a vise with the leg iron horizontal and the gaff on the top side.

(b) Use a smooth cut file and finish with a sharpening stone. Never grind with an emery wheel, as this takes the temper out of the metal.

(c) File only at and toward the point of the gaff and only on the outside. Never file the front or flat side except for a slight touching up.

(d) Do not file a long sharp point. The sharp part of the point should be about 1/8 inch (13 millimeters) long.

(e) Never use a climber with a gaff shorter than 1-1/4 inches (26 millimeters), as measured on the flat side.

(6) Climbers should not be worn when—

(a) Working on the ground,

(b) Traveling to and from a job.

(c) Piking poles,

(d) Walking through underbrush or rough terrain.

(e) Riding in motor vehicles.

c. *Concrete/steel pole climbing.* Positive fall protection should always be considered. OSHA standards (29CFR1926) requires fall protection for certain working heights above grade. Generally fall protection has been accepted as the use of a body belt. However with the development of positive fall protection devices, a positive fall protection system should be provided whenever the anchor point strength requirement can be met.

(1) *Requirement.* A fall arresting device should always be considered whenever the worker will be working more than 6 feet (1.8 meters) above ground level on line or substation structures/equipment where a feasible anchor point is available. Workers should be secured for fall arrest, while climbing or changing work positions, and for position security while working in place. Where both hands are required for working from a ladder, the requirements for either fall arrest, position security, or both, will be applied dependent upon the working height.

(2) A proper anchor point must be identified and evaluated by qualified personnel before an appropriate system can be selected. OSHA regulations indicate that pad eyes, bolt holes, and other sturdy structures, capable of supporting 5,000 pounds (2,200 kilogram) per attached worker, are acceptable.

(3) Positive systems all have in common an anchor point independent of the support method, a belt or harness to hold the worker, and a connecting device between the anchor point and the belt or harness.

(a) Belts and harnesses should only be used for the personal protective purpose for which they are designed. Their misuse could result in serious injury or death. In addition to fall-arrest harnesses, there are fall-arrest/positioning, fall-arrest/suspension, fall-arrest/retrieval, and retrieval/positioning harnesses.

(b) The choice of a belt or a harness is determined by the impact limits for a fall-arrest system. A belt may be used for impact forces up to 900 lbs (400 kilograms) while a harness has a higher force level of up to 1,800 pounds (800 kilograms). All items

of the complete fall arrest system must be taken into account, not just the belt or the harness.

(c) Manufacturers instructions in regard to height and weight should be followed for sizing of the belts or harnesses and their connecting devices and for inspection and maintenance of the complete systems. All equipment must be taken out of service and inspected for damage after being subjected to a fall impact.

(4) Workers authorized to climb must have a complete set of approved tools. The number of tools carried in tool belts must be kept to a minimum.

## 6-6. Pole climbing and work precautions

Only after determination of the pole's safety, collection of necessary climbing equipment and work tools, and assurance that the line is de-energized and grounded, or that hot-line work is authorized to be carried out, can the worker start climbing. Protect hands and arms by wearing gloves and long sleeve shirts.

a. *More than one climber.* If more than one worker needs to work on the pole at the same time, the first worker must reach working position before the next worker leaves the ground. Ordinarily, no worker is to work directly under another worker on the same pole, except in emergencies. When this condition is necessary, take extreme care to prevent tools or other objects from being dropped on the worker below.

b. *Necessary wood-pole climbing precaution.* Always proceed as follows—

(1) Seat the gaffs securely. Be especially vigilant when the pole is ice or sleet covered.

(2) Use pole steps whenever they are available, but only after checking that they can be used safely.

(3) Use the climbers carefully on the pole to avoid injury to another worker on the pole.

(4) Every precaution must be taken to avoid weather cracks, checks, knots, shakes, rots, and hard places, which might cause gaffs to cut out. Remove any tacks or nails which may impede safe climbing.

c. *Concrete/steel pole or tower climbing precautions.* Workers may be required to climb concrete/steel poles with the same equipment as wood poles. Climbing towers to work on obstruction lights, marker lights, and similar devices may be required. Before climbing the situation must be surveyed to

get a good idea of what work is to be done and where the climbing will take place. The great majority of falls are due to slick work gloves or slick shoe soles. Ice or wet weather conditions increase the hazards. Always make sure that gloves and shoe soles are in good condition and free from grease or other inhibitors. Rough cord sole shoe or boots are recommended. Careful inspection and attention must be given to the safety belt's condition and positioning, as steel or concrete surfaces can cause a belt to wear out or break due to cutting action. Climbing safety devices must be used where installed.

d. *General pole climbing precautions.* The pole climber will observe the following rules:

(1) Both hands must be free for climbing.

(2) The worker must not stand on mail boxes, signs, fire alarm boxes, or similar equipment which may be attached to the pole or located near it.

(3) Racing up and coasting down poles is positively prohibited.

(4) Safety straps must be used from the ground up.

(5) When climbing over slippery or ice-coated crossarms or timbers, where the hands are apt to slip off, two safety straps should be used. The use of rope safeties is prohibited.

(6) All signs must be removed from a pole before any worker climbs or does any work above them on a pole. It is not desirable to have signs on poles, but street signs may be necessary at times. Where street signs are removed they must be replaced after all work is completed.

(7) Climb on the high side of a raked or leaning pole if possible, but do not climb on the side where the ground wire is attached. Avoid grasping pins, brackets, crossarms, braces, or other attachments that might pull lose and cause a fall.

(8) Never slide down any type of pole or any guy wire. If it is impossible to use climbers for ascending and descending such places, ladders or other means must be used.

(9) Do not ride overhead guys or cables. (This does not apply to cables installed for river crossings or otherwise intended to support workers in suitable conveyances.)

e. *Working on poles.* Never change the amount



of strain on a pole by adding or removing wires until you are sure that the pole will stand the altered strain. If in doubt, consult your foreman. Observe the following safety precautions..

(1) Safety belts must be used by workers at all times while handling wires or apparatus on a pole or structure. The following precautions must be taken:

(a) Be careful in attaching snaps to D-rings. Visually ensure that the snap keeper is fully closed in the correct ring before any weight is applied to the safety strap.

(b) Always be sure that safety straps are not twisted while in use.

(c) Never depend on a crossarm or crossarm pins and braces for support.

(d) Never attach safety straps above the crossarm in the top gain or around insulator pins, crossarm braces, transformer hangers, pole steps, or guy wires. If there is no crossarm in the top gain, the strap must not be placed closer than 2 feet (0.6 meters) to the top of the pole. In this case take precautions to assure that the belt does not slip off. Ideally the strap should be below the top pole attachment, except where that attachment is above eye level.

(e) Do not permit any worker to fasten both safety belt snaps in the same D-ring in order to reach out farther on the pole. An extension safety strap must be used or the safety belt let out so that work can be performed with the safety belt snaps fastened one in each D-ring.

(f) Workers must not attach metal hooks, or other metal devices to body belts. Metal chains and keepers should not be used. Use leather straps or rawhide thongs with hard wood or fiber keepers. Care must be taken to prevent the snaps on the safety belts from coming in contact with anything that may open a snap. The tongue of the snap on the safety belt must face away from the body.

(2) Take the following precautions when hoisting or lowering materials:

(a) Junked material which cannot be lowered safely may be dropped only if there is no danger to workers or the public.

(b) Workers engaged in hoisting tools and materials should be positioned so that they will not be injured by an accidental dropping of the tool load.

(c) Materials and tools must not be left in an insecure overhead position. Large objects must be securely lashed.

(d) Minimize the number of tools carried in tool belts. Secure tools returned to a tool belt. Keep all other tools on the ground until they are required. Then tools should be raised and lowered by means of a canvas bucket attached to a handline. If a tool is too large to be safely raised in this manner, it should be raised by means of just a handline.

(e) Carry a handline up a pole uncoiled with one end attached to the rear of the worker's body belt. When climbing with a handline, take care to prevent the handline from fouling on any pole attachments.

## 6-7. Crossing structures

When it is necessary to climb half-way across a crossarm to inspect middle phase insulators, the worker may climb the rest of the way across, provided that, a safety belt can be kept strapped around a timber as a safeguard. To get from one side of a double-pole supported structure to the other, the worker must descend to the ground and go up the other pole unless there are adequate handholds and adequate clearances from live parts to allow safe crossing along the structure.

a. *Crossing open air switches.* Never cross through an open air switch, one side of which is energized. Energized portions of the structure must be blocked off with barriers and, if advisable, another worker should be stationed to warn anyone approaching about the danger zone.

b. *Balancing support.* Never hold onto air switch arcing horns for support in walking timbers, as these horns break easily and a fall might result.

c. *Climbing H-frames.* Never walk along an H-frame crossarm with the line energized.

## 6-8. Stringing or removing de-energized conductors

Before stringing or removing de-energized conductors a briefing must be held to discuss the plan of operation, the type of equipment to be used, any adjacent energized lines, needed grounding devices and procedures, use of crossover methods, and the Safe Clearance authorization required. Overhead ground wires require the same safety precautions.

a. *Work precautions.* Observe the following work precautions for stringing or removing lines and for all aerial line work:

(1) *Adjacent to energized lines.* When pulling wire over or near energized conductors, the worker attending the payout reel must wear rubber gloves and be positioned on an insulated stand of a size equivalent to or larger than a standard rubber blanket. The payout reel must be grounded. Any deviation on grounding payout reels requires special permission from the supervisor. A bull line, which must be of dry polypropylene rope not smaller than 1/2 inch (13 millimeters) diameter should be placed in position to pull the wire before attempting to string it. The bull line must be of sufficient length to reach the distance the wire is to be pulled. Fasten the wire to the end of the bull line and pull it into position. A car or truck should be used to pull the wire so that the driver can see the signals of the reel operator. Both in pulling in the wire and in sagging it, the pulling must be slow and steady to prevent swinging the wires into the energized conductors. The wire must be watched carefully to prevent its hanging up on tree limbs, weeds, and other obstructions. No workers should be permitted to touch any conductors or wires on the ground without rubber gloves.

(2) *Over, under, or across energized lines.* When wires are strung and sagged over, under, or across conductors carrying a voltage of 5,000 volts or less, personnel handling the wire will wear rubber gloves and use other necessary protective devices. Conductors carrying more than 5,000 volts must be positively and constantly grounded during the stringing operation. As soon as the wire is ready to be deadended, it must be grounded with standard grounding devices.

(3) *Weather.* Electrical charges may appear on the line from a lightning strike or from induced static charges from a very dry atmosphere. Discontinue operations when there is any indication of lightning in the surrounding area.

(a) *Fallen wires.* All personnel must look for fallen wires. A worker finding a fallen wire will stand by it to protect all street and highway traffic and pedestrians from the hazards. As soon as possible, another worker must be directed to telephone the facilities engineer or the appropriate superintendent to have the wire de-energized. The worker finding the fallen wire must not leave until instructed by the supervisor in direct charge.

(b) *Fire.* Electric lines close to a fire should be de-energized to protect the firemen. The lines must not be re-energized until all danger has been removed. Where lines were located close to the fire, the lines, ground wires, and guying must be inspected. Inspect insulators for cracks and crossarms

and poles for charring before the lines are restored to service.

(c) *Vehicular protection.* Wires being strung along or across streets or highways must be kept sufficiently elevated to eliminate vehicular collisions. The foreman should delegate a competent person to act as flagman. Traffic should be blocked when this line elevation is not possible.

b. *Grounding.* Requirements for grounding of de-energized lines are covered in chapter 3, paragraph 3-11. Other grounding requirements should be as follows—

(1) *Permanent ground wires.* Permanent ground wires are installed to protect workers. Remember that the metallic case, covering, or mounting support of any energized piece of electrical equipment must be considered energized at full voltage if it is not properly grounded. All permanent grounds must be installed according to the requirements of the NEC or the NESC as applicable.

(a) Ground wires must be installed clear of all metallic line equipment (except that which is normally grounded), hardware, or street lighting fixtures.

(b) Ground wires on distribution wood poles must be protected with wood molding for the entire working length of the pole and protected to prevent guy wires from cutting the ground wires. The entire working length of the pole is from the point where ground wire terminates near the top of the pole to 5 feet (1.5 meters) below the lowest crossarm or bracket, and from the ground line to 8 feet (2.5 meters) above the ground line.

(c) Never cut an overhead ground wire or neutral wires of any kind because of the need for line or equipment replacement, unless specifically instructed by your supervisor to do so. Also, avoid opening a joint in such a wire without first bridging the joint with wire of a suitable size.

(2) *Common neutral systems.* Fuses of all transformers will have been opened before-work can be done on a transformer bank where the grounded neutral wire is used for both primary and secondary neutrals. The connections from the transformer to the grounded neutral will be made before the connection from the transformer to the phase wire is made. The connection from the transformer to the grounded neutral wire must never be disconnected while the transformer is energized.

(3) **Protective grounding equipment.** Protective grounding equipment must be maintained in good condition and must be inspected immediately before being used. Use only approved screw-type ground clamps. Grounding equipment must be connected to ground point first, then to the item to be grounded.

*c. Handling and stringing.* ANSI/IEEE 524 provides general recommendations on the methods, equipment, and tools used for the stringing of overhead line conductors and ground wires. The following safety precautions are mandatory:

(1) *Reels.* Adequate braking must be used to stop all payout reels. Personnel must not otherwise touch or attempt to stop the revolving reel.

(2) *Conductors.* The inside end of the coil wire, where accessible, must be securely fastened to the reel to prevent the wire from getting loose when the wire has been paid out. If the inside end of the coil cannot be secured, a tail rope must be fastened securely to the wire before the end is reached to prevent its getting loose.

(3) *Grounding.* Bond and ground all stringing equipment, such as reel stands, trailers, pullers, or tensioners.

*d. Primary line installation.* Lines must be strung to clear the ground by an amount not less than that specified in the rules of the NESC. These minimums depend upon whether the line is above a street (consider its street traffic classification), above a pedestrian way, or over or near other structures. Wire and guys which are being strung should be kept clear of any possible interference with public traffic of any type. Where it is necessary to block traffic temporarily while wires and guys are being installed, one or more members of the crew should be assigned to direct traffic.

(1) *Stringing wire.* Stringing by facility personnel will normally be done by the tension method, since this keeps the conductor clear of energized conductors and clear of obstacles which might cause surface damage to the wire. Slack stringing may be appropriate for new short line extensions. In either case lines must be sagged to meet the requirements of the NESC.

(a) In stringing wires do not put kinks into any part of the line. Kinks reduce the strength of the wire and may result in fallen wires later.

(b) Before changing the strains on a pole by adding wires, engineering guidance should be re-

quested to ensure that the pole will safely stand the altered strain.

(2) *Clipping in or tying wires.* This involves the transferring of sagged conductors from their stringing travelers to their permanent insulator positions where they may either be clamped or tied to insulators.

(a) Wires should be securely tied-in at all tie-in type insulators to prevent the possibility of wires becoming loose at points of support and falling to the ground. Where double arms are provided, line wires should be well tied-in to insulators on each arm. This applies to pin- and post-type tie-top insulator work. Clamp-type insulators must have the clamps tightened to meet the manufacturer's requirements.

(b) When it is necessary to connect two parallel circuits at one or more points on the line, the phase wires should be tested with a potential transformer or other means, to make sure that the phase wires of one circuit are being connected to the corresponding phase wires of the other circuit. (See paragraph 3-5)

(c) Care should be taken to see that phase wires are not crossed when turning the vertical angle on three-phase lines, that is, phase wires should take the same position leaving an angle as coming into it.

*e. Secondary line installation.* Secondary lines must be installed to meet line clearance requirements of the NESC. Lines may be single or triplex wires. Secondary lines with insulation must be handled with the care insulated wire requires. Workers must be particularly careful in stringing secondary services, to avoid any undue hazard in close proximity to primary lines. Locations where the service wires might fall across conductors of a higher voltage are not permitted.

(1) Before stringing secondary wires, nearby or adjacent energized lines must be de-energized and grounded. As an exception, service wires may be installed near overhead energized lines provided the following operations are carried out in the following order. Connect service wires to the building; attach a handline to the other end of each wire and carefully raise the wire to its position on the pole; and then attach service wires to the bracket or crossarm. While these operations are being performed, workers must wear rubber gloves and use insulation to prevent shock from unintentional contact between the service wires and the primary lines. Personnel on the ground must not attempt to install meters or other secondary connections while these operations

are being performed.

(2) In the handling and stringing of weather-proof-covered wires, care must be taken not to injure the weatherproof covering.

*f. Removing lines.* Removing or salvaging wires requires the same precautions as stringing wires. The wire to be removed should be pulled out and laid flat before coiling the wire by hand or on a nonpower-driven reel.

(1) A worker should never change the strains on a pole by removing wires until certain that the pole will safely stand the altered strain. Where a pole will be weakened by the removal of the wires, it should be guyed before these wires are removed. All wires should be lowered with a handline. If this is not possible, before cutting a wire aloft care should be used to avoid contact with other wires.

(2) Lines which are being cut or rearranged should not be allowed to sag on, or be blown against other electric power lines, signal lines, signal equipment, metal sheaths of cables, metal pipes, ground wires, metal fixtures on poles, guy wires, and span wires.

(3) Wires which have been cut, or which are being arranged, should not be allowed to fall near or on a roadway where there is danger to traffic. Where it is impossible to keep these wires clear of the roadway by at least 10 feet (3 meters) or more' (depending upon the voltage of the adjacent lines) all traffic should be blocked. All persons working on lower levels of poles, where cutting is taking place, and all personnel on the ground should be notified well in advance of the cutting so that they may stand clear.

*g. Guying.* No installation or removal of guys should ever be attempted without engineering guidance.

(1) *Installation.* Install guys to meet the following requirements:

(a) When insulators are used they should be connected into the guy wire line before the guy wire is set in place. In new work, guys should generally be installed before line wires are strung. In reconstruction work, guys should be installed before any changes are made in the line wires and care must be taken not to place excessive pull on the pole and wires already in position.

(b) Guys should be installed so that there is minimal interference with the climbing space and

guys should clear all energized wires.

(c) Guy strain insulators should be provided, wherever necessary, to secure the required amount of insulation to applicable codes.

(d) Guys should be installed to the correct tension. Where necessary, a guy hook may be used to prevent the guy from slipping down the pole. These hooks should be so located that they do not interfere with climbing and so placed that they will not be used as steps. Where guys are liable to cut into the surface of a pole, the pole should be protected by a guy plate at the point where the guy is attached. The plate must be well secured to the pole to prevent the possibility of injury to a worker climbing up or down the pole.

(e) All guys should be installed so that they do not interfere with street or highway traffic. Guys located near streets, or highways, should be equipped with traffic guards. Traffic guards are sometimes called "anchor shields". Guy guards (traffic shields or anchor shields) should be yellow.

(f) Guy wires should be installed so that they will not rub against messenger or signal cables.

(g) Guy wire containing snarls or kinks should not be used for line work. It is preferable to use guy wires of the correct length to avoid unnecessary splices.

(2) *Removal of guys.* Before guys can be removed, the condition of the pole must be determined. If the pole is weak, it should be securely braced before any changes in pole strains are made.

(a) Where the removal of guys from a pole will change the strain and present a dangerous condition, the pole should be braced temporarily to make such a changed condition safe.

(b) Where it is not possible to install side guys, poles may need to be braced to be self-supporting. The pole bracing should be installed so that it will not interfere with climbing or with street or highway traffic. Pole braced guys should not be used on poles which will be climbed.

*h. Insulators.* Pick up insulators by their tops to avoid cutting gloves or hands on insulator petticoats. Do not screw down insulators too tightly because their tops may break off, cutting gloves or hands.

## 6-9. Energized line work

Refer to energized line work requirements covered

in paragraph 3-15. The rules of this paragraph amplify those requirements and cover work on aerial lines, however the nature of live line maintenance work makes it difficult to govern by hard and fast rules. Therefore, the foreman must devise safe methods on the points not covered by rules given in this manual.

*a. Live-line work safety rules.* Overhead lines should be worked deenergized when this can be done. However, live line maintenance, carefully done by industry-approved standards, has proved to be an effective method for work on electric power circuits. Recognize that energized line work demands maximum attention to safety rules by all personnel. Utilization of insulating equipment in the application of basic principles of isolation must be followed.

(1) The foreman must supervise the workers closely, and advise them as necessary. The entire responsibility for the safety of personnel engaged in live line work, as well as the enforcement of the following rules, rests with the foreman:

(a) Safe working distance from all energized wires must be maintained by workers at all times. See table 3-3 covering qualified worker minimum clearance distances. In congested locations where this is impossible, a Safe Clearance must be obtained (refer to paragraph 3-8).

(b) When it is necessary to work on energized lines carrying more than 750 volts between conductors, gloving or live line tools must be used according to table 3-5. The safety of the work depends on the integrity of the tools and protective rubber equipment. Continual inspection, in service care, and required testing are mandatory to maintain worker safety.

(c) Close cooperation must be obtained from every worker on the job. High-tempered or fractious people should never be assigned to live line work.

(d) Unnecessary conversation must not be allowed, as this would distract attention, cause confusion, and create a hazard.

(e) Haste inconsistent with safety must not be permitted.

(2) A careful check will be made to see that the condition of the structure and lines at the point of the work is such that the job may be performed safely. In addition, the adjacent spans and structures will be carefully checked for defects in conductors, tie wires, insulators, and other equipment. Other pre-

cautions include the following:

(a) Live line maintenance work will never be done at night or in wet weather.

(b) Under no circumstances will a worker depend on another worker to hold a live conductor clear of him/her.

(c) When moving heavy conductors, wire tong blocks clamps will be used on the live-line tools so that these lines may be moved slowly and carefully.

(d) While live-line work is in progress, no other work of any nature will be performed on the same pole or structure.

(e) For circuits on wood poles or attached to wooden structures, all wood members should be considered to be at ground potential.

(3) When working on energized equipment provide these precautions:

(a) Workers should, whenever possible, place all protective devices and do all work from a position below live conductors or apparatus.

(b) When it is necessary to change position on a pole, a worker must climb below energized unprotected conductors and apparatus to a position below live conductors and apparatus and then up to the new position. If two workers are on the pole, no work may be done on energized conductors until the worker changing position has reached the new location.

(c) When handling of energized lines and equipment is being done on a pole or structure, a handline must be carried up the pole and securely fastened before any work is done.

(4) Standard requirements for tools and protective equipment. The following requirements should apply:

(a) When the minimum working distance must be reached because the nature of the work requires close access, calibrated insulated measuring sticks or equivalent will be used to verify the distance. Telescoping fiberglass measuring sticks, alternately yellow and red striped at 1-foot intervals (0.1-meter intervals with a black stripe at every 1 meter interval) are recommended for monitoring minimum distances. Marking of live-line sticks to identify the minimum phase-to-ground safe work distance as listed in table 3-3 for the circuit being

worked is recommended. Alternatively, each liveline stick should be equipped with a standard flexible rubber hand guard to indicate how far out a worker can safely hold a stick.

(b) Personnel performing structure-type live-line maintenance should not carry hand tools in their belts, particularly when working from ladders. Hand tools should be raised to a worker on a structure in canvas tool bags. Hand tools should be returned to their canvas tool bags each time their use is completed.

(c) Use tested fiberglass-reinforced plastic (FRP) hotsticks. Wooden hotsticks are not recommended.

(d) Observe all rules for aerial rope use covered in paragraph 6-12.

(e) Only hook ladders made of FRP will be used in live-line maintenance. FRP hook ladders will be equipped with nonconductive safety ropes along both outside rails. Personnel on a ladder will maintain their safety straps around the ladder except when mounting or dismounting, and will have the ladder snap on their safety strap snapped to a rung of the ladder when they are in a working position and when the ladder is being moved.

(5) Link stick lines should be handled as follows—

(a) In removing link stick (fuzz lines) from energized conductors, the worker must take hold of the link stick rope and pull the link stick in before grasping the stick.

(b) When untying conductors workers must cut the tie wires off short or roll them up in a ball so they will not contact pins, crossarms, poles, ground wires, or any other conductor.

(c) When untying or tying conductors on pin type insulators, one worker at a time should work and the other should steady the conductor with a tie stick. The foreman must check the condition of tie wires and pins on poles adjacent to the one being worked on to make sure they are safe. Before moving the conductor, the foreman must verify that adequate clearance exists between the conductor and any object or wires crossing under the line in adjacent spans.

(d) Link stick lines must be tied off to a suitable anchorage on all regular live line setups. In no case will they be tied to a car or truck unless the

motor is stopped, the ignition key removed, and the brakes set.

(e) If the work to be done is on an angle, the foreman must arrange to take care of strains by providing sufficient tackle. In addition to anchoring the link stick lines, blocks must be used on the ends of the link stick ropes so the conductor can be moved slowly and carefully.

(f) Workers must not allow rope to lie across energized conductors.

(6) Work on 0 to 750 volts nominal, phase-to-phase circuits must be done as follows—

(a) When working on energized secondaries, rubber gloves (Class 0) with leather protectors must be worn.

(b) Each worker working on energized lines and apparatus must be qualified for the highest voltage class of all conductors within reach.

(c) Work must be performed on only one conductor at a time.

(d) All other energized or grounded conductors and equipment within reach must be covered with rubber or other approved protective equipment.

(7) Work on 750 to 17,000 volts nominal, phase-to-phase circuits must be done as follows—

(a) Where gloving is permitted by table 3-9 use gloves table 3-10 and wear leather protectors.

(b) At least two workers, fully qualified for the voltage range (including other conductors within reach) must be available.

(c) Only one wire on the same structure is to be worked on at a time, although it is recognized that three-phase lifting tools may be used.

(d) For lines and apparatus belonging to this voltage group, use protective equipment of the proper voltage rating. Before starting work, carefully inspect the protective equipment to make sure that it is in good serviceable condition. Workers must begin their work of covering up on the lowest or nearest conductor, as the case may be. They must never work over or reach past unprotected conductors or energized equipment, either in covering up other conductors or in connection with the work itself.

(e) When working on energized conductors

or parts, conductors within the working area must be covered with approved protective equipment. Grounds within the working area must be covered or removed from the work area, when work is being done which exposes the workers to a phase-to-ground contact. The working area is considered as the area wherein contact can be made with any conductors or other energized parts by the workers or any conducting object or tool the workers are handling.

(f) Work above energized conductors is permitted only where these conductors can be adequately covered with protective equipment or where they can be moved a sufficient distance to allow safe working space.

(g) When protective equipment is to be removed, that farthest away must be removed first. Equipment closest to the workers is to be removed last so that the workers will not have to reach past unprotected conductors.

(h) Do not remove any protective equipment until all workers are in a position where it is impossible for them to make contact with conductors or other energized parts after protective equipment has been removed.

(i) When work is being done near an energized conductor using an aerial bucket, either ground the truck or barricade the truck and work area. Establish a definite method of communication between the workers in the bucket and those on the ground. Do not move the boom when anyone is in contact with the truck.

(8) Work above 17,000 volts to 36,000 volts, nominal phase-to-phase, other than the replacement of fuses and switching, on energized lines or apparatus operating at this voltage range is prohibited. Switching and fusing energized circuits in this voltage classification must be performed under the following conditions:

(a) Must be approved by and be under the direct supervision of a qualified person devoting full time and attention to the workers and the safety of the workers.

(b) Must have at least two qualified workers available.

(c) Must use live-line tools of the proper voltage for lines and apparatus belonging to this voltage class and maintain the minimum clearance from live parts as listed in table 3-3.

(9) Other work above 17,000 volts and all work above 36,000 volts must be done by contract personnel if it is done live-line.

(10) All live-line work regardless of the voltage level, requires that normally, no worker is permitted to approach or take any conductive object closer to exposed energized parts than shown in table 3-3. Exceptions are—

(a) The tool or object has an approved insulating handle.

(b) The worker is insulated or guarded from energized parts. (Glove and sleeves rated for the voltage involved are considered insulation of the worker from the energized part).

(c) The energized part is insulated or guarded from the worker and any other conductive object at a different potential.

(d) The worker is insulated or guarded from any other conductive object.

b. *Live-line bare-hand work.* Live-line bare-hand work is not permitted.

c. *Washing of insulation on energized lines.* Washing of energized insulators requires maintaining minimum water resistance, minimum working distance, and minimum nozzle pressure. Also see IEEE/ANSI 957 on cleaning energized insulators. Conform with the minimum requirements of the facility's local utility company. Minimum values are given in IEEE/ANSI 957 but these are admittedly only guides because of the great variety in conditions, practices, contamination possibilities, and electrical system designs used by different utilities.

## 6-10. Streetlighting

Streetlighting circuits can be either low-voltage multiple circuits or mediumvoltage series circuits. It is important that the type of circuit be identified because of the voltage level differences. There should be no reason that streetlighting circuits cannot be de-energized for daytime work.

a. *Precautions.* Streetlighting line wires and streetlighting fixtures and wires, not under construction or grounded, must be considered energized and must always be worked with rubber protective equipment, unless a Safe Clearance is obtained and the line grounded. The voltage of streetlighting circuits should be treated as that of the highest voltage occupying one or more poles on which the streetlighting circuit is run. This is necessary because streetlighting

wires sometimes become crossed with live voltage wires during a fire or during the day when not in use.

*b. Multiple streetlighting circuits.* Multiple streetlighting circuits will be considered to be at the same voltage as the circuits to which they are connected, unless the circuit is on the same structure with a higher voltage wire, in which case it must be considered to be at the higher voltage level.

*c. Series streetlighting circuits.* Before a series streetlighting circuit is opened and work is performed, the following procedures will be followed:

(1) A circuit will be disconnected from the source of supply by opening disconnecting switches or other absolute voltage cutouts, and a Safe Clearance will be attached to such disconnects or cutouts. Do not depend on time switches or other automatic devices.

(2) A circuit will be properly jumpered to avoid an open-circuit condition.

(3) In replacing lamp globes in series streetlighting brackets, there is danger of an arc developing and causing serious damage and possible injury if the spring clips in the receptacle do not make contact. These springs may have been heated to the extent that they have lost their temper, or for some other reason do not close the circuit when the lamp socket is pulled out. Approved changers with at least 6-foot (1.8-meter) handles will be used for replacing lamps on series streetlighting circuits. Workers must wear rubber gloves when removing or installing lamps where lamp changers cannot be used.

*d. Climbing space.* Maintain safe access by hanging streetlighting fixtures clear of the climbing space. All bolts, lag screws, and other hardware used in securing the fixtures will be carefully trimmed.

*e. Time switches.* When winding time switches, or working on automatic time switches, do not trip the switch "on" without first pulling the transformer disconnects or making sure that lighting circuits will not be energized. On time clocks with medium-voltage connections, workers will wear rubber gloves in winding, resetting, and otherwise maintaining the clock.

## 6-11. Working on or around pole-mounted equipment

See paragraphs 5-6, 5-7, 5-8, and 5-10 for various equipment rules. These rules are the basic equipment safety rules. The rules in this paragraph apply

to precautions applicable to equipment that is mounted above grade. Be aware that some state safety orders do not permit grounding of enclosure cases on wood poles, if there is a possibility that an accidental contact with bare aerial lines might occur. Transformers connected to an energized circuit will be considered as being energized at the full primary voltage unless they are adequately grounded.

*a. Surge arresters.* Check that the permanent ground connection is intact before any work is done. Do not climb or strap off to surge arresters. Wear eye protection when connecting, disconnecting, or discharging surge arresters.

*b. Switches and fuses.* The maintenance of switches and fuses may require temporary line modifications to permit repairs where service continuity must be maintained. Both sides of fuses must be de-energized for repair work to proceed. Engineering guidance is required in preparing a step-by-step modification procedure.

*c. Capacitors.* Refer to paragraph 5-8 for discharging capacitors. Individual capacitor banks must be grounded if insulated capacitor mounting racks are not used. Provide discharging method in accordance with the manufacturer's instructions.

*d. Power transformers and voltage regulators.* Check poles and crossarms before installing a transformer or regulator on an existing pole. Consider that the following transformer requirements apply to regulators where applicable. Only qualified personnel should climb poles to fuse, inspect, and test transformers and equipment. When transformers are installed or replaced, their secondaries must be checked for voltage and phase rotation when necessary. When distribution transformers are installed and before they are energized, the ground connections must be made to the case, secondary neutral, and then to the primary neutral when used, in the order named.

(1) *Energized work.* Except for testing, replacement of fuses, and switching, work on energized pole-mounted transformers and lines is prohibited.

(2) *Installation.* To meet these requirements, engineering guidance may be necessary.

(a) All frames and tackles used in erecting pole-type transformers should be carefully inspected each time before use. Defects should be repaired before the frames and tackles are used.

(b) Wherever possible, junction poles, subsidiary poles, and streetlighting poles should not be used



as transformer poles. When it is necessary to install transformers on junction, subsidiary, or streetlighting poles, take care to maintain proper climbing space and to avoid crowding of wires and equipment.

(c) Transformers must be installed only on poles strong enough to carry their weight. Transformer poles must be straight and, where necessary, guyed to prevent leaning or raking of the pole after the transformer is hung.

(d) When transformers are raised or lowered, all crew members must stand clear and traffic must be detoured if necessary. In congested traffic, the pole space must be roped off. Personnel on the pole must place themselves on the opposite side from that on which the transformer is being raised or lowered. Pole steps and other obstructions in the path of ascent/descent of large transformers should be removed.

(e) When transformers are installed, the pole climbing space should be carefully maintained so that it will not be necessary for climbing workers to come too close to the transformer case.

(3) *Connection.* Pole-type transformers should not be installed until they are supplied with a sufficient amount of good quality oil.

(a) When a three-phase bank of pole-type transformers is replaced, the new transformers should be carefully checked for phase rotation before service is restored, so that the new service connections will be the same as before the change. Any motorized equipment revolving in the wrong direction because of incorrect phase rotation is dangerous.

(b) Rubber gloves or hot sticks must be used when installing a pole-type transformer. First connect the primary leads from the transformer to the primary cutouts; second, make sure that secondary leads from the transformer are in the clear; third, make connections from cutouts to primary line; fourth, close primary cutouts; fifth, make polarity tests on secondaries and connect permanently. When removing transformers, open cutouts and disconnect secondaries to prevent danger of "backfeed".

(c) Where one or more transformers feed into a common secondary or are paralleled on the low-voltage side, caution should be exercised in refusing, as the higher voltage terminals will be energized by stepping up the secondary voltage which is supplied by the other transformer.

(4) *Inspection and maintenance.* Only "Qualified Climbers" should be allowed to climb poles to inspect and test pole-type transformers. Never stand on or otherwise contact transformer cases, while working on or near energized circuits.

(a) Before changing or replenishing oil, all energized connections to transformers must be disconnected and a Safe Clearance provided from all live circuits.

(b) When opening transformers, do not use lighted matches or open flames of any kind.

(5) *Fusing.* When installing fuses, workers should be careful to avoid contact with any live lines, or with any grounded surfaces (grounded lines, the casings of grounded transformers, streetlighting fixtures, signal lines, signal equipment, the metal sheathing of cables, metal conduits, span wires, and guy wires).

(a) Before installing fuses in new cutouts, replacing fuses, or opening disconnects, workers must protect their eyes by wearing goggles and by turning their heads. They should use their arms to further protect their eyes and faces from any flashes or arcs that may occur. It is mandatory for the workers to wear rubber gloves or to use a "hot stick" as appropriate to the voltage level. Workers must secure themselves to the pole with their safety belts.

(b) When fuses are taken out of the circuit they should be removed entirely from the fuse enclosures or cutouts.

(c) In phasing out a transformer or in testing it for polarity, small size fuses should preferably be used.

(6) *Service connections.* Do not string service wires from a transformer pole if it is at all possible to install them at some other location. Service wires must never be installed on transformer poles, unless a minimum separation meeting code requirements can be maintained between the service wires and the energized primary conductors or apparatus.

(a) Two workers must be used in stringing services from a transformer pole where primary jumpers energized at 5,000 volts or more extend below the secondary wires.

(b) When a worker is making connections to secondary buses, the neutral wire must be connected first and energized wires connected last. The procedure must be reversed when disconnecting services.

(7) *Testing.* Testing of transformers, autotransformers, and similar equipment should be performed by qualified personnel under appropriate engineering guidance. All temporary leads used in testing such as secondary leads of potential transformer, thermometer leads, and recording voltmeter leads, should be securely supported on the pole and should clear all traffic. The positions of these leads should not interfere with the climbing space or with maintenance work which may be required while the testing is in progress.

## 6-12. Aerial rope use

Ropes are used by workers working on aerial lines. Rope qualities and use in rigging for general lifting is covered in chapter 4, paragraph 4-9. See table 4-1 which gives approximate safe working loads for ropes.

*a. Conductivity.* Always use properly maintained polypropylene synthetic rope (not natural-fiber rope) for aerial lines, handlines, and taglines for live-line work which meet ANSI/IEEE 516 requirements. Keep rope stored in a clean, dry location and protected from damage and contamination. Lines will be without wire reinforcement and, at least 1/2 inch (13 millimeters) in diameter.

*b. Rope use terms.* Rope line terminology applying to aerial line work is as follows—

(1) Handlines raise and lower light materials and tools. They may be used for holding small transformers away from the pole during raising or lowering.

(2) Throw lines are used to pull a larger rope into place for performing a task beyond the capacity of a hand line. They are small diameter ropes thrown over support objects such as crossarms or tree limbs.

(3) Bull ropes are used when a handline is not strong enough to raise heavier equipment. They are used also for fastening temporary poles, for holding out heavier transformers, and for lowering trunks or heavy limbs in tree trimming operations.

(4) Running lines are used for pulling several span lengths of wire at one time.

(5) A sling is a looped rope assembly used to hoist heavy equipment, for lashing tools or materials in place, attaching a block or a snatch block to a pole, making temporary installations such as lashing an old pole to a new pole, or tying up line wires.

(6) A safety line is used only for lowering a worker to the ground.

(7) A snatch block is a rope sheave and hook with one side of the sheave open to avoid threading the rope through a hole.

## 6-13. Tool use

Aerial line work involves the use of portable power tools and the different miscellaneous tools required in the performance of the work.

*a. Portable power tools.* Only approved portable power tools will be used on poles, towers, or structures.

(1) Electric tools and all supply lines connected thereto will be kept a safe distance under the level of all circuits or apparatus energized in excess of 750 volts, phase to phase. Supply lines will be adequately insulated and properly secured to prevent accidental contact with any conductor.

(2) Air and hydraulic-driven tools will not be used in any position where their unprotected conducting parts can come closer to any energized conductor or apparatus than the minimum working distance given in table 3-3. Cover the energized conductors or apparatus with approved protective equipment for the voltage involved where reduced clearances are required. Supply hoses will be noncurrent-carrying material throughout, properly maintained and, when in use, secured to prevent accidental contact with any energized conductor or apparatus.

(3) Power saws will be secured in an approved manner when used in an elevated position on a pole, tower, or structure.

(4) Except as permitted otherwise, noncurrent-carrying metal parts of hand-held portable electric power tools will be grounded. Approved double insulated tools and tools fed from ungrounded isolated power supplies need not be grounded.

*b. Miscellaneous tools.* Observe the following precautions in their use.

(1) Pike pole handles must be sound and free from splinters. Spear points (gaffs) must be sharp and securely fastened to a pole. When carried on trucks, pike poles must be placed so that injury is prevented.

(2) Always maintain cant hooks and carrying hooks in a safe condition.

(3) Never use jennies with cracked or broken legs, dull teeth, or loose bolts. Use only approved jennies.

(4) Never use pole jacks with defective releases, or jacks which slip when loaded.

(5) Always use approved bumperboards. These should be either 2 by 6 inch (50 by 150 millimeters) board, 6 to 8 feet (1.8 to 2.4 meters) long or 1 1/2 by 6 inch (38 to 150 millimeters) channel iron, at least 6 feet (1.8 meters) long.

(6) Never use wire reels showing any defects. All wire reels must have suitable brakes.

(7) Never leave closing-type knives open when placing them in tool boxes or other storage containers. Open knives must be kept in scabbards when not in use.

(8) Always maintain personal tools in good condition.

(9) Always maintain hot line tools in good condition. Tools must be kept clean and dry at all times.

#### **6-14. Aerial lifts and insulated buckets**

The use of aerial lifts and insulated buckets is covered in paragraph 4-11. See also table 3-9 for voltage levels where their use is mandatory.

*a. Requirements.* Workers involved in electrical operations with aerial lifts must observe the following instructions:

(1) Lift controls must be tested each day before use to determine that such controls are in safe condition.

(2) The insulated portion of an aerial lift must not be altered in any manner that might reduce its insulating value.

(3) Be aware that the vehicle may become energized (or grounded) when the boom or the aerial basket itself comes in direct contact with energized (or grounded) conductors or equipment.

(4) Do not depend upon the truck, boom, or aerial bucket to be "electrically insulated" without daily proof that each item is insulated to the necessary value. No one will be permitted to touch the truck or equipment when aerial equipment is operating in or near energized conductors. The vehicle must be grounded or considered as energized and, if energized, properly barricaded.

(5) The rules governing the requirements for use of rubber or other protective equipment while working on poles and structures also apply to work

from aerial buckets.

(6) A body belt having a secured safety strap (or approved equivalent) must be used for any work from an aerial bucket and must be attached to the boom.

(7) Bucket liners must be used if the bucket is designed to be used with a liner and must be tested according to paragraph 4-11 requirements.

(8) A safety hat and suitable clothing must be worn at all times by personnel when working from the aerial bucket and by all ground personnel.

(9) Unauthorized or unqualified persons will not be permitted to operate the aerial bucket boom.

(10) Insulated aerial lifting devices used for working on energized electrical systems must be specifically designed for that sole function. The aerial lift must be used only for electrically-related work.

(11) All personnel must stay clear of pressurized oil or air escaping from a ruptured line or fitting. The pump, compressor, or engine must be stopped as soon as a leak is detected.

(12) The manufacturers load limits of the boom or buckets must be posted on the unit and they must not be exceeded.

(13) All hydraulic and pneumatic tools that are used on or near energized equipment must have non-conducting hoses rated for normal operating pressure.

(14) An aerial crew must include a minimum of two qualified workers.

*b. Travel procedures:* Drivers of aerial bucket trucks must be constantly alert to the fact that the vehicle has exposed equipment above the elevation of the truck cab and be sure that roadways provide the necessary clearance. They must avoid moving the truck into the opposing traffic stream by planning the order of the work to eliminate this hazard. When possible the following precautions should be observed:

(1) Any backing of the truck must be done slowly and under the direction of one person on the ground who has an unobstructed view of the intended path of the vehicle and its driver.

(2) A truck must not be moved with the boom elevated in working position.

(3) When traveling to and from job sites, pin-on type buckets must either be removed and stored on the truck, or secured in a horizontal position to the boom, to avoid obstructing the driver's vision.

*c. Setting up and knocking down at the job site.* Upon arriving at the work area, legally park the truck while the vehicle and pedestrian warning signs, lights, and barricades are being placed. Give careful consideration to the location of overhead conductors and the surrounding conditions before the truck is moved into the work position. Make every effort to place the truck so that all work areas at that location may be reached by the boom without movement of the truck. Take the following precautions:

(1) Available footing for the truck wheels and outriggers must be examined carefully and extra caution exercised if there is snow, ice, mud, soft ground, or other unusual conditions. Blind ditches, manholes, culverts, cesspools, wells, and other similar construction must always be considered as additional possible hazards.

(2) Before lowering the stabilizers, outriggers, or hydraulic jacks, the operator must be certain that no one is close enough to be accidentally injured. Chocks or cribbing may be needed to ensure stability of the truck body.

(3) When working on an inclined road or street each outrigger or jack must be checked to make sure a stable setup has been achieved. The truck should be approximately level as viewed from the rear.

(4) A warm-up period is needed at the beginning of each day's work. This time may vary with different makes and models, and with different temperatures.

(5) When lowering the boom to a cradled positions, workers will stand clear of the path of the bucket and boom.

(6) When work is completed the bucket must be lowered and the boom cradled and secured by an approved tie-down.

*d. Operating at the job site.* Observe proper precautions before and while raising the bucket. Workers will obey the applicable rules for working aloft or working at ground level.

(1) One worker must be responsible for all operations required in placing the bucket in operating position, use of the bucket, and restoring it to the traveling position.

(a) That operator must check to be sure that the outriggers or stabilizers are in the down position, truck hand brake set, and rear wheels of the truck chocked where necessary.

(b) If the operator has any doubt as to the stability of the truck, due to terrain, then the outriggers or stabilizers must be checked for safe operation before a load is lifted.

(c) When the boom must be maneuvered over a street or highway, necessary precautions must be taken to avoid accident with traffic or pedestrians. A flagman must be used when necessary.

(d) workers will enter the bucket only with the bucket resting in the position for which it is designed.

(2) the operator should always face in the direction in which the bucket is moving so that all obstructions are noted and avoided when the bucket or boom is raised, lowered, or rotated.

(a) the operator must follow the proper sequence prescribed by the manufacturer in raising the boom section.

(b) Before reaching any area containing obstructions, the operator must test controls of the boom and bucket to ensure that they are in proper working order.

(c) the operator must suspend operations if tests indicate the unit is not working properly.

(d) Raising the bucket directly above energized conductors equipment should be kept to a minimum.

(3) Protection for workers aloft will be provided by locating buckets under or to the side of lines, to avoid contacting any conductors or equipment.

(a) If necessary to get within reach of energized conductors or equipment, a worker must be properly protected with rubber sleeves and rubber gloves, if appropriate to the voltage level.

(b) Energized conductors and equipment must be covered with protective devices, if necessary to perform the work safely.

(c) Adequate clearance must be maintained so that protruding tools will not come in contact with conductors, tree limbs, or other obstructions.

(d) A worker must not stand on top of the bucket or on planks placed across the top of the bucket, while performing work.

(e) A worker must not belt onto an adjacent pole, structure, or equipment while performing work from the bucket.

(f) the operator must make sure that handlines and tools do not become entangled with the levers that operate the boom.

(g) When working aloft, secure all tools not in use.

(4) When the bucket is being used in any manner which might result in contact between an energized conductor and the bucket, boom, or any attachment thereto, the vehicle must be considered energized at line potential, and the following safe practices observed from ground operations.

(a) Materials or tools must not be passed between a worker on the vehicle and a worker on the ground, unless both workers wear primary rubber gloves and use other required protective devices.

(b) Workers operating ground controls must be on the vehicle or insulated from the ground using primary rubber gloves and other protective equipment.

(c) Before entering or leaving the vehicle, a worker must make sure that the boom or bucket is not in contact with or near energized equipment.

(d) Workers on the ground must not work directly below the work area of the bucket.

(e) Tools or materials must not be thrown to or from the elevated bucket.

## 6-15. Aerial cable heating material requirements.

See paragraph 7-6 for safety requirements. Observe the following additional requirements.:

a. Soldering tools must be kept at grade level except when actually in use aloft.

b. When solder is being used aloft, an approved solder catcher must be placed directly under the point of soldering.

## 6-16. Tree trimming and brush removal

Tree trimming and brush removal is done to maintain the integrity of electric lines and apparatus and

provide right-of-way clearance.

a. *Training qualification.* Workers who climb trees must be certified as "Qualified Climbers." Workers in aerial lifts must be qualified for that work. If using ladders, review the requirements for their safe use in paragraph 4-6. In all cases, when workers are engaged in work near energized lines, they must be qualified to do so. Any trimming must be done in a manner that does not damage the tree, and meets ANSI Z133.1 requirements. The worker must be qualified to do tree trimming.

b. *Public Safety.* Erect suitable signs and barriers to prevent the public from passing under trees in which personnel are working and to prevent stumbling over brush on the ground. Brush must not be piled on sidewalks nor left on streets and highways overnight.

c. *Tool Safety.* Raise and lower tools with a handline. Only saws and pruning knives or shears are used for cutting limbs. Do not carry unnecessary tools up the tree. Tools must not be hung or stored on tree limbs.

d. *Working near energized lines.* Be aware that lines may not always be de-energized from tree trimming operation. Review the rule for live line safety and for climbing and working on a pole especially in regard to being knowledgeable of the energized lines in the area and the relevant dangers. Workers in trees will use belt and safety straps. When working near energized lines, arrange your safety line so that a slip or fall will carry you away from the energized lines.

e. *Climbing and working on trees.* Climbing trees should be avoided unless ladders or aerial lifts will not provide the necessary access. Workers in trees must use every precaution to prevent contact with aerial electric and telephone wires, and damage thereto. Ensure that the following precautions are taken.

(1) If climbers are used, make sure they are tree climbers approved for the bark thickness of the tree being climbed. Never use pole climbers.

(a) Use a belt and safety strap or life line. Place the strap around a tree limb of sufficient size to hold the worker's weight, but never around the tree limb being cut.

(b) Do not stand on tree limbs too small to support your weight. Extreme care should be exercised when working in trees which have brittle wood.

(2) Before felling trees inspect tools to be used (such as ropes, tackle, ladders, and chain saws) to ensure they are in proper condition.

(a) Place signs warning pedestrian and vehicular traffic of the danger from work being performed. Station flagmen where necessary.

(b) Inspect each tree for possible dangers (conductors and fences) in the line of fall. Have energized conductors de-energized if possible.

(c) Check each tree for dead or broken tree limbs when climbing. Remove unsound tree limbs during the climb.

(d) Lower cut-off tree limbs with a rope. Falling tree limbs can cause injury and property damage.

(e) Trees greater than 25 feet (7.5 meters) tall and 8 inches (200 millimeters) trunk diameter must have ropes attached before felling. Passing workers to the ropes to guide the tree as it falls.

*f. Power trimming equipment.* Chain-saw operators will follow the manufacturer's operating instructions and will carefully inspect and maintain their saws prior to use. Chain saws are very dangerous. Observation of the following operation and maintenance safety rules will assist in the avoidance of injury.

(1) Operate only if authorized and observe the following operator precautions:

(a) Before starting to cut, the operator must clear away brush or other material that might interfere with cutting operation.

(b) Operators will wear personal protective equipment as prescribed by the designated authority. Eye, ear, hand, foot (safety shoes) and leg protection are required as a minimum unless specifically waived by the designated authority.

(c) the idle speed will be adjusted so that the chain does not move when the engine is idling.

(d) The operator must be sure of his/her footing before beginning cutting operations.

(e) the operator will hold the saw with both hands during all cutting operations. Grip the chain saw properly. Place one hand on the top handle with the thumb curled under the handle. Place the other

hand on the control handle.

(f) The operator must stand to the side of the chain saw, not directly behind it, to keep the body away from the path of the guide bar if kickback occurs. Be alert to conditions. That can cause the chain saw to kick back. Kickback occurs when a solid object (such as a tree limb above the cutting area) contacts the chain at the guide bar nose. This causes the saw to be thrown violently up and back toward the operator.

(g) The chain saw must never be used to cut above the operator's shoulder height.

(h) The operator will shut off the saw when carrying it over slippery surfaces, through heavy brush, and when adjacent to personnel. The saw may be carried running (idle speed) for short distances of less than 50 feet (15 meters) as long as it is carried to prevent contact with the chain or muffler.

(i) Never operate a chain saw when physically tired or under the influence of alcohol, medication, or other drugs.

(j) When felling a tree, clear a path of retreat while assuring that the fall does not damage anything.

(2) Chain saws must be kept clean and sharp at all times, and kept in sound mechanical conditions with all guards, spark arresters, mufflers, handles, and other items properly installed and adjusted. Observe the following equipment precautions:

(a) Fuel for chain saws must be stored in approved vented containers that are marked to show their contents. Never store the fuel near flammable materials. Keep the containers clean. Always wipe the spout clean before filling the chain-saw tank. Filtering the fuel mixture will ensure continued smooth engine operation.

(b) make sure that a proper mixture of fuel (gasoline and oil) is used. Check the fuel tank and chain oiling reservoir for proper levels before use. The filler caps for the fuel tank and chain oiling reservoir must be clearly marked and securely attached during operation and storage.

(c) the chain saw will not be started within 10 feet (3 meters) of a fuel container.

(d) the chain saw will not be fueled while running, hot, or near an open flame.

*g. Right-of-way brush removal.* Brush clearance should be performed as part of electrical maintenance work only to clear right-of-ways. Wear personal protective equipment when using power trimming equipment. Recognize the hazards from poor work practices to workers and to the environment and observe the following rules.

(1) Cutters felling heavy brush or small trees must give sufficient warning to other personnel. Never work so close that one worker could injure another with a swinging ax or hook.

(2) Brush chippers will be operated only if authorized and by standing to the side of the chipper chute while feeding the butt end of brush into the chipper first. Use the automatic shut-off/stop control at the operator's station in an emergency.

(3) Tools such as saws, axes, bush hooks, pruning shears, scythe blades, and pitch forks, must not be lying in bushes or small trees nor stored hidden from easy view of other workers.

(4) Personnel assigned to remove or pile brush

must stay a safe distance behind workers using cutting tools.

(5) When burning brush, be careful at all times to see that the fire and sparks are under control. Cover hot ash piles with dirt or douse them with water. Obey local laws concerning open fires. The burning of poison ivy, poison oak, and poison sumac is prohibited. Smoke from burning these plants is very toxic; even the windward side of the fires may not be safe.

(6) Workers assigned to right-of-way cutting should be taught to recognize poison ivy, poison oak, and poison from these plants and should keep away from the vines and leaves. If workers do contact these poisonous plants, they should report to the foreman who will immediately render appropriate first-aid treatment to prevent a rash from breaking out on the worker's skin. A first-aid kit should always be at hand.

(7) Workers must always be on the alert for snakes when cutting right-of-way. A standard snake-bite kit must be carried on every such job.

